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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LIANG, LEONARD S

ART UNIT PAPER NUMBER

2853

DATE MAILED: 06/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/902,594

Applicant(s)

SHIBATA, TSUYOSHI

Examiner

Leonard S Liang

Art Unit

2853

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-9 and 11-13 is/are rejected.
- 7) ☐ Claim(s) 2 and 10 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 July 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 31, I2, J2, i2, j2, i2+1, and j2+1. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: S106, S107, S111, S112, S113, S121, and S122. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the means for storing a first table, means for storing a second table, designation means, selection means, and control means must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### *Specification*

3. The disclosure is objected to because of the following informalities: On page 12, lines 8-10, the specification states, "Note that a "density" hereinafter means an optical density of ink **land** on a printing medium." This is a minor grammar error. It will be construed that the specification should read, "Note that a "density" hereinafter means an optical density of ink **landed** on a printing medium." Appropriate correction is required.

4. The disclosure is objected to because of the following informalities: On page 20, line 22, the specification states, "...an image by making ink droplets fly and become **attach**..." This is a minor grammar error. It will be construed that the specification should read, "...an image by making ink droplets fly and become **attached**..." Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 9, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan (US Pat 5111302) in view of Yashima (US pat 6164747).

Chan discloses, with respect to claims 1, 9, and 13 an ink jet printing apparatus/method (See column 1; lines 13-20. The discharging of ink from a plurality of ink ejection print elements is inherent to the invention); a first table indicating a correspondence between a plurality of inks and gray scale values of print pixels (See figure 2A; column 3, lines 33-41; and column 6, lines 52-55. The means for storing a first table is inherent to the invention; having a first table would be useless without a means of storing it);

16 Levels Gray Table  
Based on 2x2 super-pixel  
Define density (reflectance) ratio to be:  
 $d1:d2:d3 = 4:2:1$

LEVEL	1/4	2/4	3/4	4/4
1	(0,0,1)			
2	(0,1,0)	(0,0,2)		
3		(0,1,1)	(0,0,3)	
4	(1,0,0)	(0,2,0)	(0,1,2)	(0,0,4)
5		(1,0,1)	(0,2,1)	
6		(1,1,0)	(0,3,0)	
7			(1,1,1)	(1,0,3)
8		(2,0,0)	(1,2,0)	(0,4,0)
9			(2,0,1)	(1,2,1)
10			(2,1,0)	(2,0,2)
11				(2,1,1)
12			(3,0,0)	
13				(3,0,1)
14				(3,1,0)
15				
16				(4,0,0)

Fig. 2A

a designation means/step (See figure 1, ref 16; column 3, lines 42-48. The designation means/step is also inherent to the invention; a printer must have a way to designate a region consisting of a predetermined number of neighboring pixels in order to properly form an image);

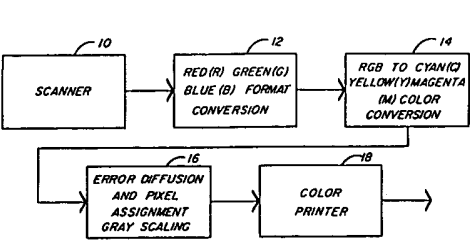


Fig. 1

a selection means/step (See figure 1, reference 16; column 2, lines 45-66. The selection means/step is also inherent to the invention; a printer must have a way to select the pixel density distribution pattern for the designated region in order to properly form an image); and a control means/step for controlling ink ejection/non-ejection of ink by looking up the **first** table in accordance with the gray scale value thereof (See column 2, lines 26-31).

Chan differs from the claimed invention in that it does not disclose a means/step for storing a second table indicating combinations of density distribution patterns of print pixels and the ink ejection print elements in correspondence with the gray scale values. Chan also does not disclose that the control means looks up the second table in accordance with the pixel density distribution patterns. Furthermore, Chan does not disclose a computer readable memory that stores a program code of an ink-jet print process for printing a visible image on a print medium; thus program codes for the designation, selection, and control steps are not explicitly disclosed.

Yashima does disclose, with respect to claims 1, 9, and 13, a means for storing a second table (See figure 6, reference 1; figure 7; column 3, lines 29-42).

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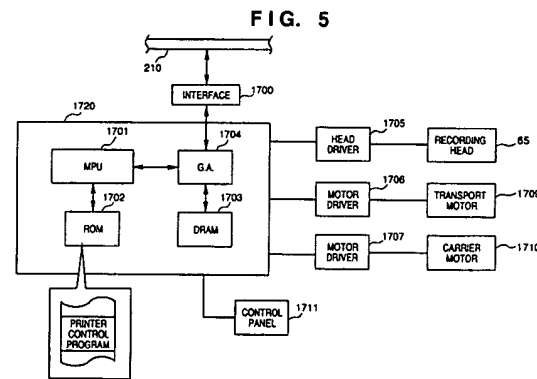
6,164,747

FIG. 7

No.	INK A	INK B	INK C	INK D	INK E	INK F	dl [i]	th [i]
0	○	○	○	○	×	×	0.0	
1	○	○	○	×	○	×	8.6	4.3
2	○	○	○	×	×	×	17.3	13.1
3	○	○	×	○	○	×	25.9	21.6
4	○	○	×	○	×	×	34.6	30.4
5	○	○	×	×	○	×	43.2	38.9
6	○	○	×	×	×	×	51.9	47.6
7	○	×	○	○	○	×	60.5	56.2
8	○	×	○	○	×	○	69.2	62.7
9	○	×	○	○	×	×	77.8	71.3
10	○	×	○	×	○	○	86.4	80.0
11	○	×	○	×	○	×	95.1	88.6
12	○	×	○	×	×	×	103.7	97.2
13	○	×	○	×	×	×	112.4	105.9
14	○	×	×	○	○	×	121.0	114.5
15	○	×	×	○	○	×	129.7	123.2
16	○	×	×	○	×	×	138.3	131.8
17	○	×	×	○	×	×	147.0	140.5
18	○	×	×	○	×	×	155.6	149.1
19	○	×	×	○	○	○	164.2	157.8
20	○	×	×	○	○	○	172.9	166.4
21	○	×	×	○	○	○	181.5	175.0
22	×	○	○	○	○	×	190.2	183.7
23	×	○	○	○	○	×	198.8	192.3
24	×	○	○	○	○	×	207.5	200.9
25	×	○	○	○	○	×	216.1	209.6
26	×	○	○	○	○	×	224.8	218.3
27	×	○	○	○	○	×	233.4	226.9
28	×	○	○	○	○	×	242.0	235.6
29	×	○	○	○	○	×	250.7	244.2
30	×	○	○	○	○	×	259.3	252.8
31	×	○	○	○	○	×	267.9	261.5
32	×	○	○	○	○	×	276.5	270.1
33	×	○	○	○	○	×	285.1	278.7
34	×	○	○	○	○	×	293.7	287.3
35	×	○	○	○	○	×	302.3	295.9
36	×	○	○	○	○	×	310.9	304.5
37	×	○	○	○	○	×	319.5	313.1
38	×	○	○	○	○	×	328.1	321.7
39	×	○	○	○	○	×	336.7	330.3
40	×	○	○	○	○	×	345.3	338.9
41	×	○	○	○	○	×	353.9	347.5
42	×	○	○	○	○	×	362.5	356.1
43	×	○	○	○	○	×	371.1	364.7
44	×	○	○	○	○	×	379.7	373.3
45	×	○	○	○	○	×	388.3	381.9
46	×	○	○	○	○	×	396.9	390.5
47	×	○	○	○	○	×	405.5	399.1
48	×	○	○	○	○	×	414.1	407.7
49	×	○	○	○	○	×	422.7	416.3
50	×	○	○	○	○	×	431.3	424.9
51	×	○	○	○	○	×	439.9	433.5
52	×	○	○	○	○	×	448.5	442.1
*	○	○	○	○	○	○	457.1	450.7
*	○	○	○	○	○	○	465.7	459.3
*	○	○	○	○	○	○	474.3	467.9
*	○	○	○	○	○	○	482.9	476.5

Yashima also discloses a computer memory that stores a program code (See figure 5, reference 1720; column 12, lines 25-52).





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It would have been obvious to one having ordinary skill in the art at the time the invention was made to include the means/step for storing a second table into the invention of Chan in order to indicate combinations of density distribution patterns of print pixels and the ink ejection print elements in correspondence with the gray scale values. The motivation for the skilled artisan in doing so is to gain the benefit of improved image quality; by being able to store and control pixel density information, graininess can be reduced, and image quality can thus be improved (See Chan column 1, lines 52-57).

It would have been further obvious to one having ordinary skill in the art at the time the invention was made to include the computer readable memory disclosed by Yashima into the invention of Chan in order to store a program code of an ink-jet print process for printing a visible image on a print medium. The motivation for the skilled artisan in doing so is to gain the benefit of being able to "remember" the information produced by the designation, selection, and controlling steps; with computers being such a popular tool in today's society, it would be impractical to store image pixel data without having a computer memory that stores a program code. Thus, the program codes for the designation, selection, and control steps are inherent to the invention as well.

6. Claims 3 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claims 1 and 9 above, and further in view of Tsao (US Pat 4651287).

Chan in view of Yashima differs from the claimed invention in that it does not disclose the selecting of the pixel density distribution pattern on the basis of a difference between a value of a pixel of interest of the pixels that form the region, and an average value of gray scale values of all pixels which form the region.

Tsao teaches, with respect to claims 3 and 11, “the image data, which represents picture elements of varying gray scale values, is partitioned into an image data array. In accordance with this method a print array is computed where each print value of the print array corresponds to each image datum. An error array is then computed by computing the **differences** between the print values (i.e. value of a pixel of interest) and the image data (i.e. an average value of gray scale values of all pixels which form the region).” (See column 4, lines 12-22)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Tsao into the invention of Chan in view of Yashima in order to select the pixel density distribution pattern on the basis of a difference between a value of a pixel of interest of the pixels that form the region, and an average value of gray scale values of all pixels which form the region. The motivation for the skilled artisan in doing so is to gain the benefit of getting high-quality images; these high-quality images are produced by applying the algorithm known as “error diffusion”, which is well known to one of ordinary skill in the art, and which is implicitly described by the language of claims 3 and 11. Furthermore, the invention of Tsao also discloses the use of error diffusion (See column 2, lines 65-68).

7. Claims 4 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claims 1 and 9 above, and further in view of Sasaki (US Pat 4714964) and Tsao.

Chan in view of Yashima differs from the claimed invention in that it does not disclose that a plurality of combinations of density distribution patterns of the print pixel and ink ejection print elements are prepared for a single gray scale value, and the control means sequentially or randomly selects these combinations.

Sasaki discloses, with respect to claims 4 and 12, a plurality of combinations of density distribution patterns of the print pixel (See figure 2, references 0-16).

FIG. 1  
PRIOR ART

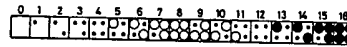


FIG. 2

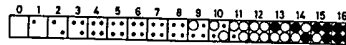
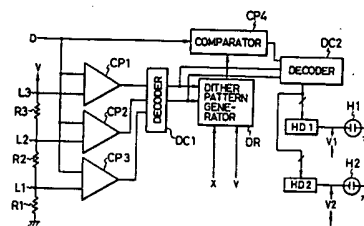


FIG. 3



Tsao teaches, with respect to claims 4 and 12, “A processing apparatus is provided to receive the image input array and for computing a print array of print values where each print value corresponds to one of a fixed number of gray scale values...” (See column 3, lines 64-68). Thus Tsao teaches that the ink ejection print elements are prepared for a single gray scale value. Since the processing apparatus is receiving the density information through an array, it is inherent that the control means sequentially or randomly selects the combinations of density distribution patterns.

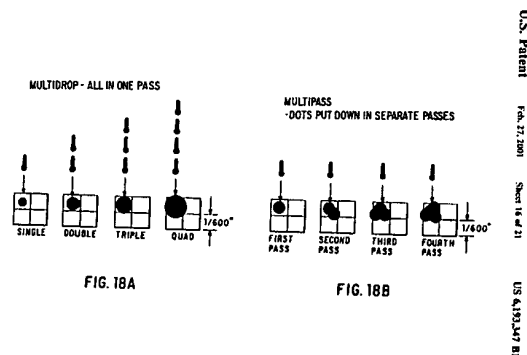
It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Sasaki and Tsao into the invention of Chan in view of Yashima in order to prepare a plurality of combinations of density distribution patterns for a single gray scale value, where the control means sequentially or randomly selects these combinations. The motivation for the skilled artisan in doing so is to gain the benefit of

improved image quality; by being able to choose from a plurality of combinations of density distribution patterns, graininess can be reduced, and image quality can thus be improved.

8. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claim 1 above, and further in view of Askeland (US Pat 6193347).

Chan in view of Yashima differs from the claimed invention in that it does not disclose that the control means adopts an ink-jet printing method of discharging double ink droplets onto at least a single unit pixel, and prints the visible image by discharging one or a plurality of ink droplets onto the unit pixel.

Askeland discloses, with respect to claim 5, the discharging of double-ink droplets onto at least a single unit pixel (See Fig. 18A; column 16, lines 60-67).



It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Askeland into the invention of Chan in view of Yashima in order to discharge double ink droplets onto at least a single unit pixel. The motivation for the skilled artisan in doing so is to gain the benefit of being able to achieve good image quality. "The ability to achieve good tone scale is crucial to achieving photographic image quality...also, the ability to place more than one drop from a given printhead into a pixel is essential to achieving this photographic image quality." (See Askeland column 3, lines 59-67)

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claim 1 above, and further in view of Askeland and Dispoto (US Pat 4680645).

Chan in view of Yashima differs from the claimed invention in that it does not disclose that the control means adopts an ink-jet printing method of discharging ink droplets having at least two different dot sizes, and prints the visible image by discharging one or a plurality of ink droplets onto a unit pixel.

Askeland discloses, with respect to claim 6, the discharging of ink droplets having at least two different dot sizes (See figure 18A; column 16, lines 60-67).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Askeland into the invention of Chan in view of Yashima in order to discharge ink droplets having at least two different dot sizes. The motivation for the skilled artisan in doing so is to gain the benefit of achieving quality gray scale printing. Dispoto teaches, with respect to claim 6, "A further advantage of the invention is that now quality gray scale printing can be achieved at resolutions previously thought too low to be suitable for the ED approach. Specifically, it has been found that a gray scale image produced in accordance with the invention using a **variable dot size** printer...results in an excellent quality image free of image artifacts." (See column 2, lines 53-61)

10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claim 1 above, and further in view of Toshiaki (US Pat 6338538).

Chan in view of Yashima differs from the claimed invention in that it does not disclose that the control means adopts an ink-jet printing method of discharging at least two multi-density ink droplets for the same hue, and prints the visible image by discharging one or a plurality of ink droplets onto a unit pixel.

Toshiaki teaches, with respect to claim 7, "The present invention relates to a printing system with a head, which **forms at least two different dots having different densities per unit area** on an object, for recording multi-tone images by the dots formed by the head, as well as to a method of recording such images." (See column 1, lines 8-12)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Toshiaki into the invention of Chan in view of Yashima in order to discharge at least two multi-density ink droplets for the same hue, and to print the visible image by discharging one or a plurality of ink droplets onto a unit pixel. The motivation for the skilled artisan in doing so is to gain the benefit of improving the quality of a recorded image (See Toshiaki column 1, lines 61-67).

11. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chan in view of Yashima, as applied to claim 1 above, and further in view of Askeland and Inoue (US Pat 5111302).

Chan in view of Yashima differs from the claimed invention in that it does not disclose that the plurality of ink ejection print elements are integrated and lined up, and express a halftone image by controlling a plurality of ink dots to land on substantially a single print pixel on a print medium when they are scanned a plurality on a number of times in a direction different from the line-up direction while being moved relative to a print medium by a predetermined width in a direction different from the scan direction.

Askeland discloses, with respect to claim 8, a plurality of ink ejection print elements (See figure 1, references 18; column 2, line 32), which produce a plurality of ink dots to land on substantially a single print pixel on a print medium when they are scanned a plurality of number of times (See figure 18A, column 16, lines 60-67).

Inoue discloses, with respect to claim 8, the printing of a plurality of ink dots that are scanned in a direction different from the line-up direction (being moved relative to a print medium by a predetermined width is inherent to the invention).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the teachings of Askeland and Inoue into the invention of Chan in view of Yashima in order to allow the plurality of ink ejection print elements to be integrated and lined up, and express a halftone image by controlling a plurality of ink dots to land on substantially a single print pixel on a print medium when they are scanned a plurality on a number of times in a direction different from the line-up direction while being moved relative to a print medium by a predetermined width in a direction different from the scan direction. The

motivation for the skilled artisan in doing so is to gain the benefit of achieving greater image quality (See Askeland column 3, lines 59-67; column 4, lines 1-5).

***Allowable Subject Matter***

12. Claims 2 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: Claims 2 and 10 include the limitation of a "apparatus/method...wherein said control means/step looks up the first and second tables on the basis of a value near a value obtained by dividing a sum total of gray scale values of pixels which forms the region by the predetermined number of pixels," which was not found, taught, or suggested in the prior arts.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Berry (US Pat 3977007) discloses gray tone generation.

Logan (US Pat 4638373) discloses a method and apparatus for improving gray scale resolution in an ink jet printing system.

Itoh (US Pat 4595948) discloses a multicolor ink jet recording apparatus having means for preventing blurring of ink.

Murai (US Pat 4667250) discloses a halftone digital image-processing device.

Wen (US Pat 6352328) discloses digital ink jet printing apparatus and method.

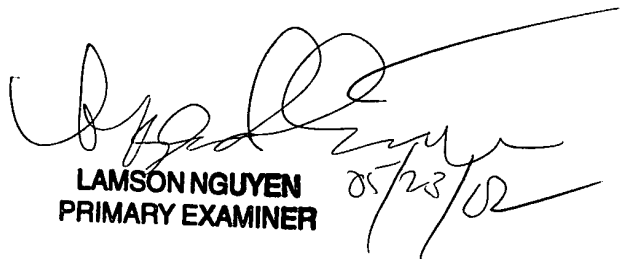
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonard S Liang whose telephone number is (703) 305-4754.

The examiner can normally be reached on 8:30-5 Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Barlow can be reached on (703) 308-3126. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

lsl  
May 23, 2002

  
**LAMSON NGUYEN**  
**PRIMARY EXAMINER** 05/23/02